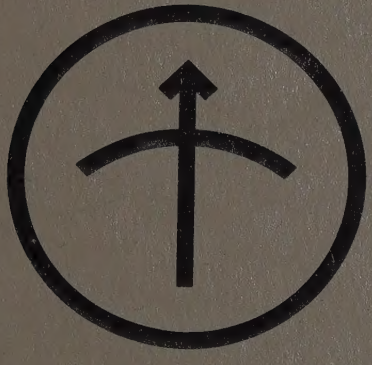
ID No. SYL-J219
– RETURN TO –
INSTRUMENT CONTROL
SYLVANIA SEG – West

MODEL 159RF MEGACYCLE METER

Operating INSTRUCTIONS



MP MASTER
MA24300

MEASUREMENTS
A McGRAW-EDISON DIVISION
BOONTON NEW JERSEY

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FOREWORD

Additional information with regard to the applications and maintenance of this equipment will be available from time to time. Users of the Model 159 RF Megacycle Meter are urged to discuss their problems with us and to suggest such modifications as might make the instrument more adaptable to their special requirements.

Whenever possible, maintenance difficulties should be reported to Measurements before proceeding with the actual repairs. Through our familiarity with the instrument, we are in a position to suggest the most expedient and accurate repair procedure.

Your Model 159 RF Megacycle Meter has been designed and manufactured to the highest standards of instrument quality. With reasonable care, many years of trouble-free service can be expected of it.

Megacycle meters are available in the following ranges:

Model 159 LF 0.1 to 4.5 Megacycles.
Model 159 RF 2.2 to 420 Megacycles.
Model 159 UHF 420 to 940 Megacycles.

The Model 159 Power Supply is a common source of power for these three Megacycle Meters.

Engineering Department
MEASUREMENTS

A McGraw-Edison Division

Boonton, New Jersey

FIGURE 1. MODEL 159 RF MEGACYCLE METER

CHAPTER 1

INTRODUCTION

1. SCOPE OF MANUAL

a. This manual describes the basic operation, construction and maintenance of the Model 159 RF Megacycle Meter. Following the text of the manual are two appendices. Appendix I describing the recommended procedure for preparing the instrument for prolonged storage or re-shipment. Appendix II contains an Identification Table of Parts, listing reference symbols, name and description, and drawing number of each part required for maintenance.

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2. GENERAL

a. The Model 159 RF Megacycle Meter is a compact oscillator covering a frequency range of 2.2 to 420 megacycles and may be used as follows:

1. As a grid-dip meter.
2. As a variable frequency oscillator, either modulated or unmodulated.
3. As an absorption wavemeter.
4. As an oscillating detector, or as a tuned diode detector.

b. Power for the Model 159 RF Megacycle Meter must be supplied from a Model 159 Power Supply.

c. The hook on the bottom of the case fits the slot located on the top right hand edge of the power supply.

d. The frequency tuning knob for the Model 159 RF Megacycle Meter is located on the front of the Meter. All other functional controls are located on the front panel of the Model 159 Power Supply. REFER TO THE MODEL 159 POWER SUPPLY MANUAL FOR OPERATION OF THESE CONTROLS.

3. TECHNICAL CHARACTERISTICS

a. FREQUENCY CHARACTERISTICS:

1. Continuously variable from 2.2 to 420 megacycles with seven plug-in coils.

2. Ranges:

2.2	-	5.4	megacycles
5	-	11	megacycles
9.5	-	22.5	megacycles
20	-	46	megacycles
42	-	102	megacycles
95	-	250	megacycles
200	-	420	megacycles

b. FREQUENCY CALIBRATION:

1. Each unit is individually calibrated to better than 2% accuracy. However, the accuracy obtainable under operating conditions depends on the technique of the user. This technique is described in Paragraph

2. The calibration is essentially linear over the entire frequency range.

c. MODULATION:

1. Internally from Power Supply, 120 cycles, or externally as selected.

d. POWER SOURCE:

1. Model 159 Power Supply.

4. COMPONENTS SUPPLIED

Quan.	Description	Dimensions		Weight
		Diameter	Depth	
1	Model 159 RF Megacycle Meter	3-3/4"	2"	1#
1	Model 159 RF Set of Coils			
1	Manual of Operating Instructions			
1	Tube, Type 955 Installed			

CHAPTER 2

OPERATING INSTRUCTIONS

5. INSTALLATION

a. The Model 159 RF Megacycle Meter is completely portable and requires no permanent installation.

6. PRELIMINARY OPERATIONAL CHECKS

a. Select a coil from the set of coils and plug it into the socket at the top of the Model 159 RF Megacycle Meter.

b. Insert the six-prong plug at the end of the flexible cable of the Model 159 RF Megacycle Meter into the six-prong receptacle at the rear of the Model 159 Power Supply.

c. Insert the 3 wire power cord into the 3 prong receptacle at the rear of the Model 159 Power Supply and to a power source of 115 V 50-60 cycles AC.

d. Switch power on by rotating the Sensitivity Control in a clock-wise direction. The lighted meter face will indicate that the power is applied. Allow one minute for the tube to warm up. Adjust the Sensitivity Control for an on-scale reading.

e. A regulator tube is located in the Model 159 Power Supply and should be ignited for proper operation.

CHAPTER 3

MAINTENANCE INSTRUCTIONS

7. GENERAL

a. Preventive maintenance procedure is not recommended for the Model 159 RF Megacycle Meter. Preventive maintenance is a series of operations including inspection, adjustment, lubrication, tec., recommended periodically for certain types of equipment to eliminate the possibility of unexpected interruptions in service. Critical adjustments may be disturbed by too-frequent inspection by personnel unfamiliar with the design of the Model 159 RF Megacycle Meter. This may result in maladjustments causing errors in data that would be much more serious than an occasional operational failure.

8. CIRCUIT FAILURE

a. Most circuit failures will be evident from indications of the grid current meter M1, and reference to the schematic diagram. Failure to oscillate may result if the unit is dropped.

b. If failure occurs, the instrument should be checked by the procedure outlined in Paragraph 6, and if trouble other than a defective tube is indicated, the instrument should be returned to Measurements.

c. If the seal on the instrument is broken without the permission of Measurements, the one-year guarantee will be void.

9. TUBE REPLACEMENT

a. To replace the 955 tube remove the tuning knob and the three screws holding the side. Lift off the cover exposing the tuning dial, etc. Remove the tuning dial, taking care not to touch or smear the calibration numbers. Place the dial face up and cover it while it is out of the unit.

The cathode clip of the 955 must be slipped loose radially first. The 955 can then be removed by a slight twisting, counter-clockwise motion.

Insert the new 955 and twist slightly into place, taking care to see that all four pins line up properly. DO NOT FORCE into place. Slide the cathode (center pin) contact clip into place. Replace the tuning dial and its three mounting screws. Replace the cover and knob and leave the three cover screws, slightly loose, so that it will be possible to rotate the cover.

Turn the tuning knob as far as it will go clockwise and rotate the cover so that the fiducial falls over the long end mark on the dial. Tighten the three case screws.

10. RECOMMENDED EQUIPMENT

a. The only test equipment required is that which is necessary for checking frequency calibration. A Model 111-B Crystal Calibrator is recommended for this purpose.

CHAPTER 4

TECHNICAL SERVICE

11. SCOPE

The purpose of this chapter is to acquaint operating and maintenance personnel with the theory of operation of the various circuits in the Model 159 RF Megacycle Meter.

12. CONDENSED THEORY OF OPERATION

a. V3 is connected in a Colpitts type oscillator circuit with the inter-electrode capacitance of the tube providing the feedback.

b. The oscillator is tuned by means of a split-stator type capacitor, C5 and C6.

c. The tank inductance is either of the coils L2, L3, L4, L5, L6, L7 or L8 as selected. The oscillator is coupled to external circuits to be tested by means of these coils.

13. SELECTION OF COILS

Frequency ranges are marked on each coil except for the two highest frequency coils. Frequency limits of the corresponding scales are marked on the oscillator unit. After insertion of the desired coil, it is advisable to set the tuning knob to mid-scale, and then adjust the sensitivity knob to approximately 50 on the grid current meter. Normal variation of the grid current with tuning will then usually remain on scale over the entire range of that particular coil. (Note: on some low frequency coils it may be necessary to readjust the sensitivity knob at the extremes of the tuning range.)

14. COUPLING

Either inductive or capacitive coupling of the Model 159 RF can be made to circuit under test. For most tuned circuits it may be more convenient to utilize inductive coupling. Maximum coupling (and largest dip in grid current) will result with the axis of the oscillator coil at right angles to the current flow.

Some types of tuned circuits are well shielded magnetically, so that it is difficult to utilize inductive coupling. For these applications, it may be necessary to use a one or two micromicrofarad coupling capacitor. This can be obtained by twisting together an inch or two of hook-up wire. This capacitance should be kept as small as possible, since it will affect the frequency calibration accuracy of the Model 159 RF. Fortunately it is not usually required that loaded (low "Q") circuits be located as accurately in frequency as higher "Q" ones.

Completely enclosed resonant cavities usually have some type of coupling loop which can be utilized with the aid of an auxiliary external transmission line and coupling loop as a link coupling arrangement for coupling inductive to the Model 159 RF.

15. SPECIAL MEASUREMENTS

a. It is possible to measure the resonant frequency of a quartz crystal by holding it close to the oscillator coil. Loose coupling is required for accurate frequency determination. Since the "Q" of the crystal is high, it is desirable to use head phones to determine the grid dip with its accompanying "click" in the phones.

15. Special Meansurements - Continued

b. The Model 159 RF can be used for measuring capacitance by connecting the capacitor to a coil of known inductance. Alternatively, the unknown capacitor may be connected in parallel with a calibrated variable capacitor connected to a coil and tuned to resonance at a given frequency. The change in capacitance required to restore resonance is equal to the unknown capacitance.

c, The inductance of inductors can be determined by connecting them to a known fixed capacitor, or to a calibrated variable capacitor, and measuring the resonant frequency with the Model 159 RF. Reference to standard Reactance-Frequency graphs will facilitate the determination of the value of the known inductance.

16. FREQUENCY ACCURACY OF MEASUREMENT

The greatest frequency accuracy of the Model 159 RF can be obtained by proper use of the instrument. In general, if the coupling to the circuit under test is too close, the oscillator will be detuned or "pulled". To obtain the greatest accuracy, couple the Model 159 RF tightly to the circuit under test for the initial search of a dip in grid current or zero beat. After the initial indication is obtained, decrease the coupling as much as practicable while still obtaining an indication.

APPENDIX I

1. STORAGE

a. Remove dust from controls and outer surface of instrument with a clean rag.

b. Wrap instrument in heavy wrapping paper and seal seams with gummed tape or similar adhesive.

c. Store in a dry place. If excessive humidity is unavoidable, the wrapped instrument should be placed in a moisture-proof bag with a sufficient quantity of drying agent, such as silica gel, to insure a dry atmosphere.

(1) When the use of bag and desiccant is necessary, the instrument should be checked at 6-month intervals to determine the effectiveness of the seal.

2. SHIPMENT

a. Wrap the instrument with heavy wrapping paper and seal seams with gummed tape or similar adhesive.

b. Place in fibre-board carton or wooden box large enough to permit at least 3 inches of excelsior or similar packing material between the instrument and sides of the box.

(1) For export packing, the instrument must be wrapped in waterproof paper and the seams sealed with glue or similar sealing compound before being placed in a wooden box.

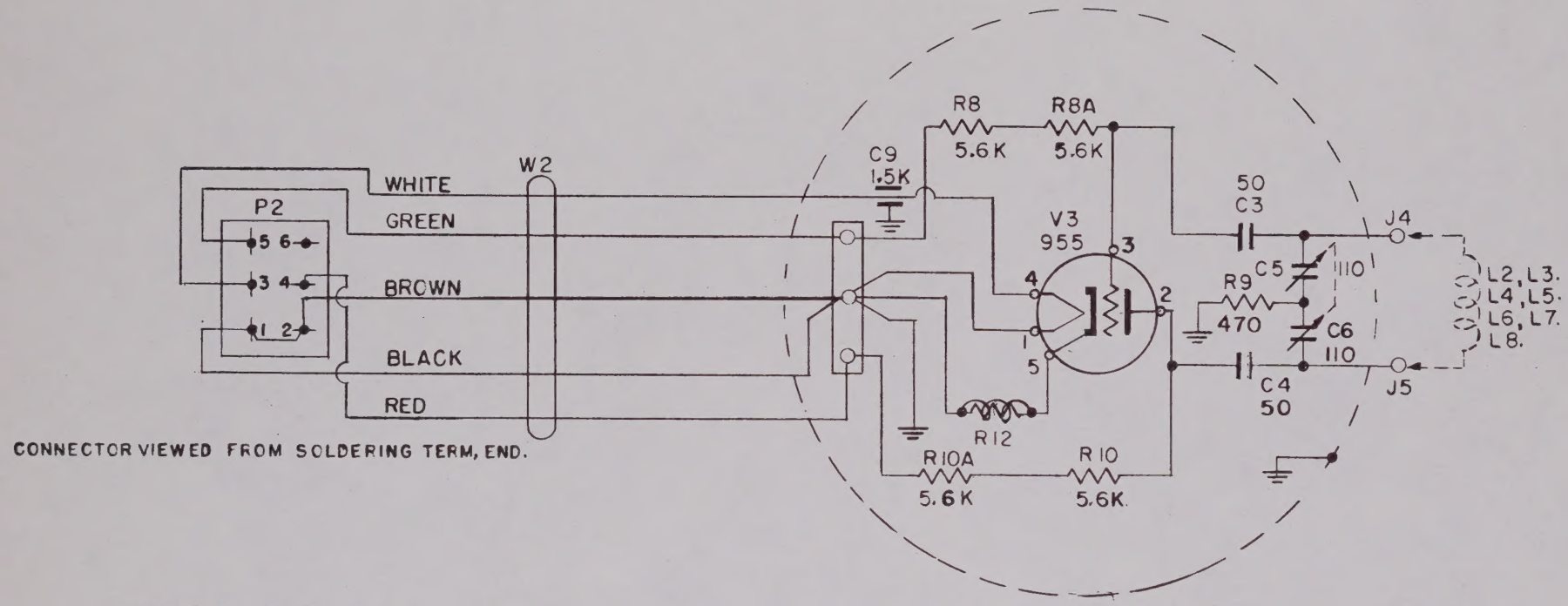
APPENDIX II
TABLE OF PARTS
MODEL 159 RF

Symbol	Measurements Part Number	Description
Capacitors		
C3	*	Fixed; mica 50 mmf. Part of C5.
C4	*	" " 50 mmf. Part of C5.
C5)	HM-403	Variable, air dielectric; two sections
C6)		10 to 110 mmf each.
C9	H-6619-3	Fixed; ceramic 1500 mmf GMV.
Knob		
E2	H-7740-5	Round.
Foot		
H1	H-7767	Rubber.
Sockets		
J4	*	Part of C5.
J5	*	Part of C5.
Coils		
L2	H-3190-1	RF; 2.2 - 5 Mc.
L3	H-3190-2	RF; 5 - 10 Mc.
L4	H-3190-3	RF; 10 - 22 Mc.
L5	H-3190-4	RF; 22 - 45 Mc.
L6	H-3190-5	RF; 45 - 100 Mc.
L7	H-1973	RF; 100 - 250 Mc.
L8	H-1974	RF; 200 - 400 Mc.
L9	HM-463	Coil Set; comprises L2, L3, L4, L5, L6, L7 & L8 mounted in coil rack.
Connector		
P2	H-7743	Plug; male 6 prong.

* Not recommended for field replacement.

APPENDIX II
TABLE OF PARTS
MODEL 159 RF

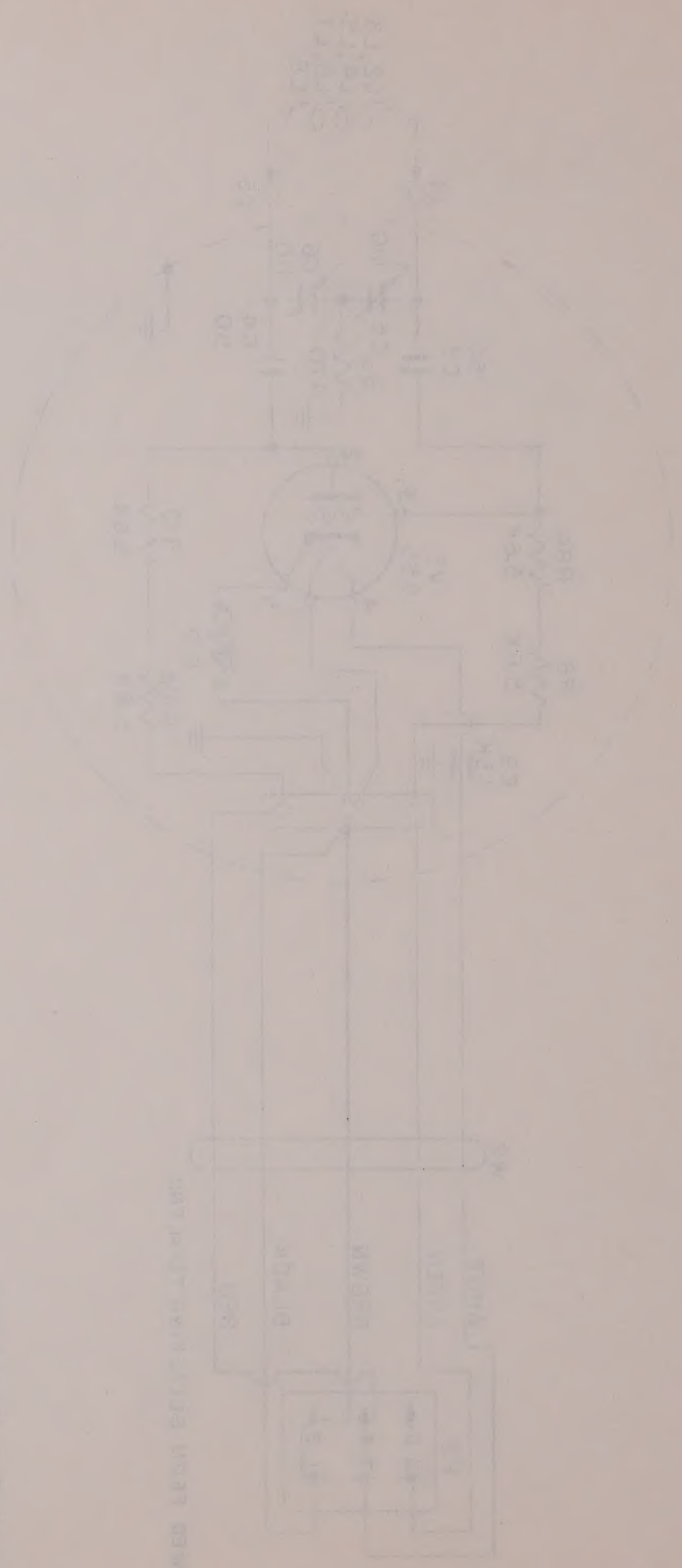
Symbol	Measurements Part Number	Description
Resistors		
R8	H-3728-562	Fixed; composition; 5.6 K ohms 10%, 1/2 W.
R8A	H-3728-562	" " 5.6 K ohms 10%, 1/2 W.
R9	H-3728-471	" " 470 ohms 10%, 1/2 W.
R10	H-3728-562	" " 5.6 K ohms 10%, 1/2 W.
R10A	H-3728-562	" " 5.6 K ohms 10%, 1/2 W.
R12	H-1980	Quock, resistor and coil.
Tube		
V3		Electron; triode; type 955.
Cable		
W2	H-886	Flexible; 5 conductor.
	H-7766	Flexible; 5 conductor. Includes P2.



SCHEMATIC DIAGRAM
MODEL 159 RF

UNLESS OTHERWISE SPECIFIED
ALL RESISTORS 0.5 WATT.
ALL CAPACITORS IN MMF.

B-7732



MEASUREMENTS

BOX 180, BOONTON
NEW JERSEY

MP MASTER
MA24300